Fermilab

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Memorandum

May 14, 2009

To: Bruce Chrisman

From: Nancy Grossman

Subject: Revised FESHM Chapter 5031.5 – Low Pressure Vessels

FESHM chapter 5031.5, Low Pressure Vessels, has been revised. Changes include adding "Special Responsibilities" section, pressure test requirement, making various changes throughout to clarify wording, and adding a couple of definitions. This chapter was out for labwide review, all comments have been addressed.

After final approval, please return this approval page to Elizabeth Bancroft at MS119 for posting on the web.

Encl.

Recommended for Approval:

Bruce Chrisman — Date 5/27/09

Approved:

Piermaria Oddone — Date 6/2/09

LOW PRESSURE VESSELS

INTRODUCTION

Improper operation of closed vessels poses a potential hazard to equipment and personnel from rupture or collapse. This chapter identifies common situations to be evaluated to reduce hazards. This chapter applies to any closed vessel used at Fermilab that is not addressed in FESHM 5031 or FESHM 5033 and which is not covered in the exclusions listed below.

DEFINITIONS

The Code – ASME Boiler and Pressure Vessel Code, Section VIII, Divisions 1 and 2. The latest revision of the Code shall be applied to a given vessel at the initiation of the vessel's design.

Low Pressure Vessel - any closed vessel pressurized to less than 15 psig.

Qualified Person - a person who, by possession of a recognized degree or certificate of professional standing, or who, by extensive knowledge, training and experience, has successfully demonstrated the ability to solve or resolve problems relating to the subject matter and work.

Engineering Note - a written analysis demonstrating that a given vessel satisfies the requirements of this chapter.

Existing Vessels - A vessel previously used on the Fermilab site. An existing vessel has an engineering note. There are no 'grand-fathered' vessels.

MAWP – Low pressure vessel's Maximum Allowable Working Pressure as defined in the ASME Boiler and Pressure Vessel Code.

EXCLUSIONS

This chapter does not apply to:

1. Vessels containing less than 35 cubic feet (261 gallons) of volume
2. Vessels where the product of pressure * volume is less than 515 psig-ft3
3. Open vessels
4. Industrial drums used for transport and storage of liquid products
5. Piping
6. Oil-filled electrical devices covered by NFPA or NEMA standards

SPECIAL RESPONSIBILITIES

The division/section head that controls the area of operation of the vessel is responsible for carrying out the requirements of this chapter. The division/section head or his/her designee shall:

1. Arrange for the review of the Engineering Note by a qualified person or committee.
2. Certify vessel compliance with this chapter by signing the Engineering Note
3. Maintain an open, updated file on all low pressure vessels within the scope of this chapter located in their areas of operation.
4. File the original note with the ES&H section.

The ES&H Section shall:

1. Assign pressure vessel numbers.
2. Maintain a master file of the engineering notes.
3. Audit the divisions and sections on their compliance with this chapter.

The Mechanical Safety Subcommittee (MSS) shall serve the division/section heads and ES&H Section in a consulting capacity on all pressure vessel matters.

RESPONSIBILITIES

Any closed vessel within the scope of this chapter shall be considered a low-pressure vessel. There are no 'grand-fathered' low-pressure vessels. All existing and new low pressure vessels must conform to the requirements of this FESHM chapter.

1. Design: The MAWP of the vessel shall be established by accepted engineering practice. The ASME Code is not mandatory for vessels having an internal or external pressure not exceeding 15 psi under Section VIII, Division 1, Paragraph U-1(h), but the design rules may be applied to low pressure vessels.
2. Pressurization: If the vessel can be pressurized beyond its rating, either intentionally or inadvertently, pressure relief devices shall be included in the design. Consideration shall be given for relief of over-pressure from all possible sources, including release of gases or fluids (by design or by accidental rupture of internal components), heat, fire, connected sources (such as compressors or compressed gas cylinders through valves or regulators), etc. A relief device must remain directly connected to the vessel while the vessel is in service.

   2.1. A properly sized relief device requires that the design pressure of the vessel be determined; that the relief valve shall be set so that the vessel does not exceed its design pressure; and that the relief device be sized such that the capacity of the relief device exceeds the capacity of the pressurization source.

2.2. Re-closing type relief valves with a relieving pressure under 15 psid are not required to be UV-stamped.

2.3. Non-re-closing and re-closeable type relief devices such as rupture discs and flip-lids with a relieving pressure under 15 psid are not required to be UV-stamped.

2.4. All relief devices shall be certified by the manufacturer for relieving pressure. A test report and an analysis predicting the flow shall be included in the Engineering Note.

2.5. Calculations of relief valve sizing shall be included in the Engineering Note. Reference ASME Code Parts UG125-136 and CGA Handbook of Compressed Gases Chap. 5.

2.6. A list of all potential means of pressurization shall be compiled.

3. Vacuum: If it is possible to draw a vacuum on a low pressure vessel, then a vacuum vessel engineering note must also be prepared in accordance with FESHM Chapter 5033. A vacuum relief device shall be included in the design and consideration shall be given for relief of vacuum from all possible sources, including pump-down or draining of liquids, etc. Vacuum relief may be provided by:

   3.1. Vent – Provide an appropriately sized vent to cause the vessel to be open to atmosphere.

   3.2. Vacuum Relief Device – Provide an appropriately sized vacuum relief device. This requires that the vacuum level permissible in the vessel be determined; that the vacuum relief device shall be set so that vacuum does not exceed the permissible level; and that the relief device be sized such that the capacity of the relief device exceeds the capacity of the evacuation source. A list of all potential means of evacuation shall be compiled.

4. Relief devices used on low-pressure vessels are not required to be retested as required by FESHM 5031.4. However, the relief devices shall be visually inspected every three years and opened (if appropriate) every 6 years.

5. Prior to putting the low-pressure vessel in service, all relief devices shall be installed and the documentation requirements satisfied.

6. Vessels within the scope of this chapter shall be pressure tested per Fermilab ES&H Manual Chapter 5034.

DOCUMENTATION REQUIREMENTS

A qualified person shall prepare a written engineering note for each low-pressure vessel not exempted from this chapter describing the vessel, installation, design details, and how the MAWP was established. The engineering note shall include relief valve size, capacity, manufacturer and model number, the relief device sizing calculations, and the documented list of all of the potential means of pressurization or potential means of

evacuation. The Note shall also include precautions and operating procedures necessary for the safe use of the vessel. Similar vessels may be covered under a single engineering note.

All Low Pressure Vessel Engineering Notes shall be reviewed by an independent, qualified reviewer, other than the engineer who prepared it, for concurrence to this chapter. The reviewer shall be from a group not reporting to the preparer of the Engineering Note or his supervisor.

After the low-pressure vessel number has been assigned, the low-pressure vessel shall be labeled with this number.

The pressure test report shall be appended to the Engineering Note.

Any subsequent change in usage, operating temperature, valving, etc., which could affect the safety of the vessel, requires an amendment to the original Engineering Note. This amendment shall be reviewed in the same manner as the original Note.